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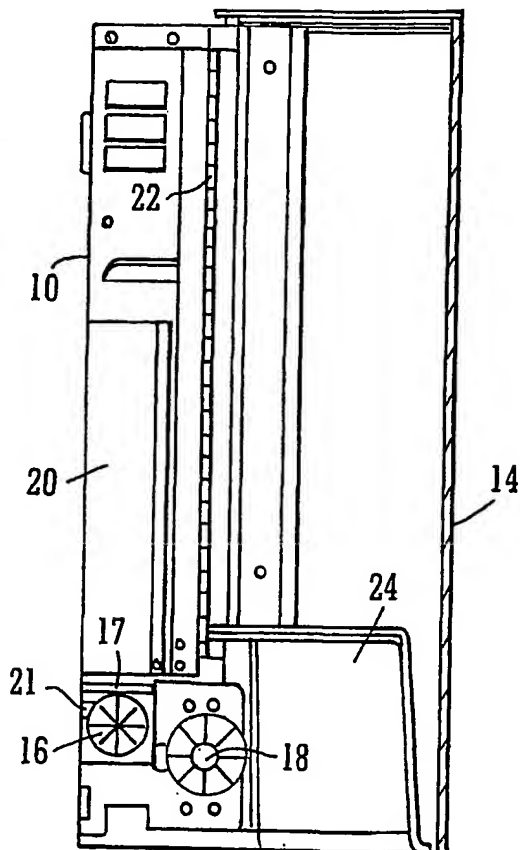
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(54) Title: APPARATUS FOR PRODUCING AN OPTICAL ILLUSION, IMAGE OR EFFECT



(57) Abstract: Apparatus for producing an optical effect, in particular a flame simulating effect is described. The apparatus arranges a light source below a reflecting means and a means for modifying light from the light source in front of the light source and below a partially diffusing and partially transmitting viewing screen. The apparatus uses alternative heat sources whereby the conventional fan heater is dispensed with, allowing quieter operation and a reduction in the front-to-back dimension of the appliance.

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Apparatus for Producing an Optical Illusion, Image or Effect

The present invention relates to apparatus and appliances for producing an optical image or illusion, in particular a flame effect. Most preferably the apparatus
5 provides a simulation of real flames in a fireplace. The apparatus includes at least one heat source sufficient to give the impression of warmth to the apparatus, the output of the heat source preferably being insufficient to provide effective space heating. Flame simulating apparatus in general are well known and have been described in, for example, GB 2 230 335, WO97/41393 and GB 2 275 105.

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Conventional flame effect fires provide an illusion of flames, usually behind a simulated fuel bed. To provide space heating, a primary heat source is included which may be radiant bars as in a conventional electric fire, a convection heater or, more usually, a fan heater mounted within the casing of the fire and expelling
15 heated air through a grille in the casing of the fire.

The market for flame effect fires is developing and the inventors of the present application have appreciated that a flame effect fire may no longer be required to provide the primary heat source in a room, since an increasing proportion of
20 domestic dwellings have central heating systems. For this reason, the flame effect fire may be required only as a source of a small amount of supplementary heat (if any), with the aesthetic appearance of the fire assuming the greatest importance. Thus the primary heat source may be dispensed with.

25 However, dispensing with the primary heat source brings disadvantages, most especially that the apparatus becomes cold to the touch. This is contrary to the illusion of a warm burning fire which the optical effect is primarily intended to provide. The same deficiency can, of course, occur with a fire having a primary heat source, since a heat source such as a fan heater will not necessarily
30 significantly heat the housing of the fire. Thus the inventors propose to incorporate a low output heater which makes the housing of the fire sensibly warm, that is, so that the housing feels warm to the touch.

Most prior art appliances, such as described in the above patents, are intended for use as an electric fire located in a conventional fireplace. As such, the fire is designed so that a major part of the fire fits into the recess of the fireplace or stands on a hearth. The overall depth of the fire (i.e. its front-to-back dimension) can be relatively great, since this dimension can be accommodated in the recess of the fireplace or on the hearth. However the inventors have further appreciated that there is a demand in the market for a fire of sufficiently small front-to back dimension to enable it to be mounted directly on a plane wall surface, which has the advantage of increasing the possible number of locations of the fire, especially in modern houses, flats and apartments where there is no conventional fireplace and further allows enhancements of the aesthetic appearance of the fire, for example in what may be perceived as a more modern idiom.

This, in one form, the present invention seeks to provide an apparatus for providing an image, optical illusion or effect, in particular a flame simulating effect in a fire and which is suitable for mounting directly on a wall, that is, without the need for any sort of recess in the wall to accommodate the apparatus. In order to achieve such an apparatus which is commercially and practically acceptable, the apparatus of the present invention is desirably constructed to have a depth which is considerably less than conventional apparatus. In another form, the present invention seeks to exploit alternative heat sources in a flame effect fire, which heat sources contribute to reduced dimensions for the fire and so to an enhanced aesthetic appearance of the fire and which, moreover provide a sensation of warmth to the fire while not being required to provide significant space heating. The present invention is not, however, confined to apparatus intended for mounting on a wall and is applicable to apparatus for mounting in conventional locations such as traditional fireplaces.

According to the present invention, there is provided an apparatus for producing an image comprising:

- i) a housing;
- ii) radiant heating means mounted to the housing and adapted to make the apparatus sensibly warm; and

iii) an image providing assembly mounted in the housing and comprising:

(a) a light source;

(b) a viewing screen capable of diffusing and transmitting light; and

(c) means for modifying light from the light source to produce an image of

5 moving light on the viewing screen,

wherein the radiant heating means comprises at least one member selected from the group comprising: a glass panel heater and a laminate heating means comprising an electrically insulating layer having an electrically conductive heating element thereon.

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In a much preferred embodiment the image providing assembly provides a simulation of flames on the viewing screen, whereby the apparatus takes the form of a flame effect fire. Images of other sorts, for example purely abstract images may alternatively be provided by the image providing assembly simply to give a

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Preferably the laminate heating means is non-rigid. The laminate heating means may comprise in one form an electrically conductive heating wire in a meandering path applied directly or indirectly to the electrically insulating layer. The wire may

20 ideally be sandwiched between electrically insulating layers. In another form the laminate heating means may comprise a substrate carrying a printed circuit which acts as a resistance heating circuit. The printed circuit may also be sandwiched between electrically insulating layers. In either form, individual heating element sections may be connected either in series or in parallel. In either form, an

25 important feature of the laminate heating means is its flexibility which allow it to conform to the surface to which it is, in use, applied.

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Most preferably the housing is adapted for mounting on a substantially plane wall area.

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In a preferred arrangement the housing comprises a body portion and a frame portion mounted on the body portion, the frame portion defining a viewing aperture through which the image from the image providing assembly is viewed in use.

Preferably the body portion comprises at least a rear wall, left and right side walls and upper and lower side walls. Suitable fixing formations are preferably provided on the rear wall of the body portion by means of which the apparatus may be suspended on the wall. The main function of the frame portion is to define the viewing aperture and to enhance the appearance of the fire by preventing a user viewing the apparatus generally from the front from seeing the body portion. In one variation the radiant heating means comprises said laminate heating means, the laminate being disposed on the inner surface of the frame portion. The laminate may be applied to substantially all, or only some, of the inner surface of the frame portion.

In one embodiment of the invention, the viewing screen consists of said glass panel heater.

In a preferred embodiment the apparatus comprises a substantially transparent front screen disposed on said housing in front of the viewing screen. The front screen may serve simply to prevent the ingress of dust and dirt into the apparatus. However, in a particularly preferred embodiment, the front screen consists of said glass panel heater.

In one particularly preferred arrangement, the front screen is mounted on said body portion and within said viewing aperture.

Preferably, the means for modifying the light from the light source comprises means for producing moving beams of light of which one preferred form comprises a shaft mounted substantially horizontally for rotation about its axis, said shaft having a plurality of generally radially directed pieces of reflective material depending therefrom, said pieces being effective to reflect light from the light source onto the screen. Preferably the shaft is disposed in front of the plane of the viewing screen (the front of the fire being that which is facing the user in use).

In a particularly preferred arrangement the shaft is driveably connected at its first end to a motor for rotation of the shaft and is retained at its second end in a

supporting bracket, the shaft having a flexible portion or a flexible connecting portion about by flexure of which the shaft is displaceable from its operative position thereby to permit access to the light source. Most preferably the shaft is connected to the motor via a flexible bush and the second end of the shaft is
5 releaseably mounted in the bracket, the shaft being displaceable when desired by flexure of the flexible bush.

Preferably the means for modifying light include reflecting means operative to reflect light from the light source onto the viewing screen. Preferably the reflecting
10 means are operative to reflect light from the means for producing moving beams of light onto the viewing screen. Preferably the reflecting means comprises a sheet of reflective material. The reflective material may have a non-smooth surface, to introduce an element of randomness into the reflection.

15 The reflecting means may comprise a sheet of material having reflecting regions and non-reflecting regions. The reflecting regions may be generally flame shaped. In one variation, the reflecting surface of the reflecting means may be concave. The reflecting and non-reflecting regions may be formed by any suitable means such as treating a sheet of reflective material to make regions thereof matte, or
20 attaching shaped pieces of reflective material to a dull or matte backing substrate.

Most preferably the reflecting means is mounted directly against a rear wall of the housing.

25 In particularly preferred embodiments of the invention the apparatus, further comprises a simulated fuel bed disposed directly in front of the viewing screen.

Preferably, the viewing screen comprises a reflective front surface whereby a reflection of the fuel bed can be seen in the viewing screen. In this way, the
30 simulated flames (i.e. the image) in the screen appear behind the simulated fuel bed and in front of its reflection, so that the flames appear to emanate from the middle of a combined fuel bed comprising the simulated fuel bed and its reflection. The front screen is preferably located directly in front of the fuel bed.

Preferably the light source comprises a plurality of bulbs mounted adjacent a rear wall of the housing. Thus, in this preferred arrangement the light source is mounted behind the means for producing moving beams of light. From time to time, light bulbs of the light source will fail. In order to change a bulb of the light source, a user simply needs to release the second end of the shaft from its mounting and draw the second end of the shaft forwards causing the bush at the first end to bend. Access to the bulb or bulbs is then possible and when the bulb has been changed, the second end of the shaft can be re-mounted in its bracket.

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Preferably the light source comprises at least two, preferably three or four horizontally aligned bulbs. Preferably the bulbs each have a width (front to back dimension when in use) of not more than about 40mm; more preferably the bulbs have a width of not more than about 35mm. Suitable bulbs which meet these width criteria are so-called "candle" bulbs.

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In a particularly preferred arrangement the apparatus further comprises at least one reflector mounted between the light source and a rear wall of the housing. Preferably this reflector is mounted on the rear wall of the housing. The reflector may be a mirror, or a polished metal surface, for example. The reflector is useful and effective in maximising the amount of light from the light source which falls on the means for producing moving beams of light, and also for minimising the heating of the rear wall of the housing by heat emitted by the light source. By maximising the light falling on the means for producing light by use of the reflector, the size and/or power of the light source can be reduced so that the front-to-back dimension of the apparatus can be minimised. As an alternative to the reflector, halogen type bulbs could be used. However, halogen bulbs are significantly more expensive and, in the environment of the apparatus of the invention, where the apparatus must be rapidly and conveniently assembled and be robust in transport and fitting, are inherently less reliable. The use of the reflector behind the light source facilitates the use of standard tungsten filament type bulbs.

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In a particularly preferred embodiment, the apparatus comprises a baffle arranged to prevent light from the light source from falling directly on the viewing screen. In some embodiments, the baffle may be arranged to prevent light from the light source from falling on the fuel bed, other than via the means for producing moving
5 beams of light.

Typically, when present, the laminate heating means has an output of around 200W to about 700W, preferably not more than about 300W.

10 Preferably, the glass panel heater has an output of from about 50W to about 200W, especially from about 80W to about 150W, more especially about 100W to 140W and in particular about 120W. Thus the main function of the glass panel heater is to provide a sensation of warmth from the apparatus of the invention, so that the apparatus is warm to the touch for example. This is an important factor in
15 enhancing the optical illusion provided by the apparatus. The power output of the heater is deliberately set to be sufficient only for this purpose and is not intended to be sufficient for significant space heating of a room.

In an especially preferred arrangement where the means for producing moving
20 beams of light comprises a shaft mounted substantially horizontally for rotation about its axis, said shaft having a plurality of generally radially directed pieces of reflective material depending therefrom, the pieces are effective to reflect light from the light source directly or indirectly onto the screen and directly onto the underside of the fuel bed. Thus light from the light source striking the pieces of reflective
25 material is reflected by those pieces. Because the pieces of reflective material are rotating about the shaft, the light is reflected at constantly changing angles (since effectively the angle of incidence of the light on the pieces of reflective material is constantly changing). This causes light reflected from the pieces of reflective material, (optionally after further reflection by the reflecting means) to trace a path
30 up the screen, giving the appearance of moving flames. The pieces of reflective material are preferably non-planar to further vary the angle of reflection of the light and to contribute to a random appearance of the flame-like image on the screen.

For a better understanding of the invention and to show how the same may be carried into effect, reference will be made by way of example only to the following drawings in which:

- 5 Figure 1 is a schematic sectioned perspective view of an apparatus according to the invention;

Figure 2 is a cross-section of an apparatus similar to that of Figure 1;

- 10 Figure 3 is a schematic view of a reflecting means employed in the invention;

Figure 4 illustrates in greater detail the means for producing moving beams of light;

- 15 Figure 5 shows a detail of the mounting of one end of the means for producing moving beams of light;

Figure 6 shows the means for producing moving beams of light in its displaced position;

- 20 Figure 7 is a perspective view of a frame portion of a housing according to the invention; and

Figure 8 is a schematic representation of a laminate heating means used in the present invention.

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- Referring now to the drawings the apparatus comprises a housing 10 preferably of metal having a body portion 12 and a frame portion 120 (shown partially in Figure 1 and not shown in Figure 2). The housing retains a front screen 14 of a suitable optically transparent material. Where the front screen 14 serves only as a
- 30 protective screen it may preferably be of a glass or possibly plastic material through which the flame simulating arrangement of the fire can be viewed. The front screen 14 does not normally form part of the flame simulating arrangement and may serve

primarily to enclose the flame simulating components to prevent the ingress of dust, for example.

5 The preferred flame simulating arrangement shown in the examples is given by way of illustration only, other flame simulating arrangements being possible. The term "flame simulating arrangement" is generally used herein to include arrangements which provide an image or illuminated effect on a viewing screen 22 preferably, but not necessarily, a simulation of flames. The flame simulating arrangement of the exemplary illustrated fire comprises a light source 16, means 18 for modifying the
10 light from the light source 16 to provide the appearance of movement, a reflecting means 20, and a viewing screen 22. The apparatus of the invention preferably further comprises a simulated fuel bed 24 which may be formed from a plastic material moulded in to a suitable shape and suitably coloured to represent pieces of solid fuel (such as coal or logs) resting on an ember bed. Separate simulated fuel
15 pieces, such as of ceramic material may additionally, or alternatively, be provided in the fuel bed. The fuel bed 24 is illuminated from below by the light source 16. A baffle 17 is provided so that the fuel bed 24 is not significantly directly illuminated by the light source 16. Rather, the light from the light source 16 is first modified by the means 18 so that the intensity of the light falling on different parts of the fuel
20 bed 24 varies in an apparently random manner, simulating the changing intensity of light from glowing embers. The baffle 17 also serves to prevent light from the light source from falling directly on the viewing screen 22 (see especially Figure 2). An electric supply is provided through flex 15.

25 The means 18 for modifying the light from the light source 16 preferably comprises a shaft 26 which is mounted essentially horizontally in use. The shaft is rotated about its axis by a motor 28. Depending from the shaft 26 is a plurality of pieces of reflective material 30. These pieces 30 may be of metal, metal foil, metallised plastic or the like and are arranged to extend generally radially from the shaft 26.
30 The pieces 30 need not lie exactly radially and considerable variance from an exact radial alignment is acceptable. The individual pieces 30 may be planar or may be twisted. Light from the light source 16 strikes the pieces 30 as they rotate about the shaft 26 and is reflected by the pieces 30 towards the reflecting means 20 and

towards the underside of the fuel bed 24. The rotation of the pieces 30 about the shaft 26 causes the light from the light source 16 to be reflected at constantly changing angles with respect to a vertical plane (i.e. up and down the reflecting means 20) and if the pieces 30 are twisted this effect is enhanced by reflection at
5 constantly changing angles in the horizontal plane (i.e. across the reflecting means from side to side). The result is an apparently random movement of the light. The means 18 for modifying light from the light source may have alternative constructions provided that an equivalent or comparable effect is achieved. For example, the means 18 may comprise pieces of reflective material such a pieces of
10 glass or mirror tiles apparently randomly mounted on the outer surface of a rotatable cylinder so that light striking the glass or mirror pieces is reflected in an apparently random manner. Any of the reflecting components of the means 18 may be coloured in appropriate colours such as reds, greens, oranges and blues to enhance the appearance of the image in the viewing screen 22.

15 From the reflecting means 20, the light is reflected onto the viewing screen 22 to form a perceptible image. In some possible arrangements at least some of the light reflected by the means for producing moving beams of light may fall directly on the viewing screen 22. However, preferably all of the light from the means for
20 producing moving beams of light is reflected from the reflecting means 20 onto the viewing screen 22. The reflecting means 20 may be an essentially planar sheet of material, or the sheet of material may be curved or uneven in shape. The whole surface of the sheet may be reflective, or only part thereof may be reflective. In a preferred arrangement, the reflecting means 20 comprises a sheet of material
25 having reflective areas which are approximately flame shaped with the remainder of the sheet being essentially matte. The reflective areas may be formed from one or more cut-outs 20a of metal or other reflective material having the approximate shape of flames applied to an essentially matte front surface 20b of the sheet. The surface 20b may, for example be matte black. Alternatively, an essentially reflective
30 sheet may have regions which are made matte by etching, painting or the like. Providing reflective areas in flame shape enhances the flame-like appearance of the image in the viewing screen 22. Other arrangements of the reflecting means are possible, but may require an increased depth (i.e. front-to-back dimension) of the

overall fire. For example, the reflective means may comprise a reflective back sheet which reflects light from the light source 16 through a further sheet disposed in front of the back sheet, the further sheet having flame shaped apertures through which light passes after reflection by the back sheet. A supplementary light source
5 160 is preferably provided to illuminate the fuel bed directly from above which significantly enhances the overall effect.

The viewing screen 22 is preferably a planar glass screen but may be curved. The viewing screen may comprise a planar front surface and a non-planar back surface
10 and may be a laminate comprising a transparent front screen portion and a partially diffusing rear screen portion, the rear screen portion optionally being non-planar. The viewing screen 22, or the rear screen portion, may alternatively be formed from suitably optically transmissive plastics material. The viewing screen 22 is constructed to be partially diffusing of light and partially transmitting. Such screens
15 are described in, for example GB 2 275 105. The partially diffusing nature of the screen enhances the flame like nature of the image which is viewable in the screen 22. In preferred arrangements, the front surface of the screen (as seen by a user) is made partially reflective so that the fuel bed 24 is reflected in the screen. In this way the image of the flames appears to emanate from the middle of a combined
20 fuel bed comprising the fuel bed 24 and its reflection in the screen 22. Preferably the screen 22 is darkly tinted or "smoked" so that the internal components of the fire are not visible when the fire is not in use.

A further important feature of the fires according to the invention is the provision of
25 the heat source. Conventional fires have mounted a convector heater or, more commonly, a fan heater in the fire housing, sometimes at the base so that the outlet for air heated by the fan heater, and the fan heater itself, are arranged essentially horizontally and sometimes at the top of the housing so that the outlet for air heated by the fan heater, and the fan heater itself, are arranged essentially
30 horizontally or at most at about 45° to the horizontal. This arrangement is satisfactory where space is not restricted as when, for example, a significant part of the depth of the fire is inset into the recess of the fireplace. However this arrangement is not satisfactory for a fire intended for possible wall mounting, as in

preferred embodiments of the present invention, since a fire of the depth required to accommodate a conventionally mounted heater would be obstructive and unattractive in use. Furthermore fan heaters inherently make a certain amount of noise when in use which is undesirable for users. Moreover, more and more homes are now centrally heated, so that a fire of any sort is no longer required to provide the primary heat source for a room. Accordingly the inventors of the present invention have appreciated that the primary heat source such as a fan heater can be dispensed with altogether. That is, in the apparatus of the invention no primary heat source is provided since the apparatus is not intended to provide any significant or effective amount of space heating. The omission of the primary heat source facilitates a reduction in the overall size of the apparatus and allows aesthetic considerations to be given greater prominence in the design of the apparatus. A reduction in size can be advantageous whether or not the apparatus is intended for wall mounting. For example, where a relatively bulky fan heater is no longer required, more space may become available for other components of the apparatus.

In order to avoid the sensation that the apparatus of the invention is cold, which would be detrimental to the overall realism of a flame effect, the apparatus is provided with a low output supplementary heater in locations which are, desirably, not immediately apparent to a user. In a much preferred arrangement, the apparatus is provided with a glass panel heater. Glass panel heaters as such are known and conventionally comprise a glass panel onto which a layer of a metallic resistance heating material is applied. A typical resistance heating material is tin oxide (SnO_2). The tin oxide is applied in a thin layer so that the glass panel remains essentially transparent at all temperatures. The resistance of the layer is generally determined by its thickness, width and length, with the resistance, for a given layer thickness, being proportional to the length and inversely proportional to the width of the layer (length being measured parallel to the direction of current flow and width being measured perpendicular thereto). For a given current supplied to the layer the heat output is generally proportional to the resistance of the layer. The resistance heating layer is most preferably sandwiched between two layers of glass, so that the layer is protected from damage.

- The glass panel heater may be incorporated into the heating appliance of the invention as the viewing screen 22, in which case the glass panel heater must be provided means to allow it to be partially diffusing and partially transmitting of light. A supplementary diffusing panel may be provided on the rear side of the glass
- 5 panel heater to provide the required diffusion of light. Alternatively, for example, the rear surface of the glass panel heater may be rendered partially diffusing by abrading, etching or like means. The front surface of the glass panel heater when serving as the viewing screen 22 is preferably made partially reflecting, whereby an image of the fuel bed may be observed in the viewing screen 22.
- 10 Preferably, however, the glass panel heater is incorporated into the heating appliance of the invention as the front screen 14. The glass panel heater then serves the functions both of space heating and preventing ingress of dust, dirt and the like into the appliance. Preferably the glass panel heater when mounted on the housing is located immediately behind the frame portion 120. The frame portion
- 15 120 and the body portion 12 of the housing 10 are preferably so sized and shaped that the frame portion 120 obscures the whole of the body portion 12 when observed generally from the front of the appliance, except for the area of the front screen 14 or viewing screen 22 (as appropriate). This provides the appliance of the invention with a particularly neat and elegant appearance.
- 20 As can be seen from Figure 8, the frame portion 120 is generally rectangular defining a rectangular aperture 122. The frame portion 120 comprises upper and lower wall portions 120a,b and side wall portions 120c,d respectively internal edges 120e of which define the aperture 122. The edges 120e preferably lie adjacent the front screen 14, preferably so that there is substantially no gap therebetween. The
- 25 wall portions 120a-d each include a respective edge lip part 120a', 120b', 120c' and 120d' and sloping parts 120a'', 120b'', 120c'' and 120d'' which extend between the edge lip parts and the internal edges 120e defining the aperture 122. Thus the edge lip parts 120a', 120b', 120c' and 120d' lie rearwardly of the edges 120e. The frame portion 120 includes on its internal face (not shown) fixings for attaching the
- 30 frame portion 120 to the body portion 12 of the housing 10. In this way, the frame portion 120 obscures from a user's view (when the user is standing generally in front of the apparatus) all of the body portion 12, other than the front screen 14

and components which may be viewed through the front screen 14. Depending on the construction of the body portion 12, the frame portion 120 may take alternative shapes, such as square or polygonal, or even circular or oval.

5 The glass panel heater, when mounted on the body portion 12 of the housing and serving as the front screen 14, generates heat to the extent that it becomes warm to the touch, giving the user the impression of heat generation from the flame effect and fuel bed. Typically the glass panel heater has an output of around 120W.

10 In another arrangement there is provided, as a sole heat source or in conjunction with the glass panel heater as above, a laminate heating means 40 comprising a serpentine or meandering heating element 42 which may be in the form of a wire sandwiched between electrically insulating layers 44 or a printed resistance heating circuit applied to a substrate. These sorts of laminate heating means are known in the art and are provided as a sheet material which is flexible and, within reasonable
15 limits, can be made to conform with any surface to which it is applied. The laminate heating means 40 may desirably be provided with a layer of heat reflecting material, such as metallic foil material on its face which is exposed in use to reflect heat in a desired direction. In accordance with the present invention the laminate heating means 40 is applied to an inner surface of the housing 10, most preferably
20 to an inner surface of the frame portion 120 of the housing 10. The laminate heating means thereby provides warmth to the housing, without providing significant space heating. In most preferred arrangements, the sole heat source is the glass panel heater since this simplifies the construction of the apparatus, and the output of the glass panel heater is sufficient to provide the impression of
25 warmth to the housing so that additional heat output from the laminate heater is unnecessary.

For mounting the fire directly on an essentially plane wall surface, the fire is desirably made as slim as possible (i.e. of a reduced depth) so that it does not
30 penetrate too far into the room. In order to assist in this, the light source 16 preferably comprises one or more (preferably three or four) so-called "candle" bulbs which have a narrower lateral dimension than standard tungsten filament bulbs,

typically not more than 40mm, preferably not more than about 35mm. Preferably the candle bulbs are each rated at 60W. Other bulbs such as halogen bulbs may alternatively be used. However, halogen bulbs are more expensive and less reliable, as noted above. The smaller size of these bulbs enables them to be

5 mounted behind the means 18 for producing moving beams of light and achieves a significant space saving. Typically, two to four, preferably three or four, bulbs are used as the light source 16 in the lower part of the housing, together with one or two bulbs 160 in the upper part of the housing, which is/are also preferably rated at about 60W. In order to maximise the amount of light transmitted from the light

10 source to the fuel bed and the viewing screen (via the means 18) a rear reflector 21 may be mounted behind the light source. The rear reflector 21 is preferably plane but may possibly be non-planar, such as parabolic. The rear reflector 21 may comprise a sheet of polished metal, a metallised plastic sheet or a mirror, for example. Provision of the rear reflector avoids the need for extra bulbs to achieve a

15 given illumination, so avoiding adding to the dimensions and complexity of the apparatus. Equally, the provision of the rear reflector may allow the bulbs to be of a lower rating while achieving a necessary light intensity falling on the means 18 for producing moving beams of light. The rear reflector 21 is also effective in preventing transmission of heat from the light bulbs to the rear wall of the body

20 portion 16, so that the rear wall is not significantly heated by the bulbs 16.

In preferred forms of the invention the total heat output is not more than about 500W, preferably not more than about 450W and especially about 420W. In one preferred form the heat output is the sum of five 60W light bulbs (nominally 300W)

25 and a glass panel heater with an output of 120W. It will be appreciated that an output of this sort is not generally effective for space heating in a normal domestic environment.

A consequence of mounting the light source 16 behind the light modifying means

30 18 is that the means 18 obstructs access to the light source 16 for changing the bulbs when, at the end of their life, they fail. The present invention overcomes this problem by making the means 18 displaceable so that access can be gained to the light source.

As can be seen in particular in Figures 4, 5 and 6, the shaft 26 of the means 18 is connected at a first end to a motor 28 so that drive is transferred from the motor 28 to the shaft 26 to rotate the shaft 26. The shaft 26 is connected to the motor 28 by means of a bush 32. The bush 32 is made from a rubber or other similarly flexible material. The other end of the shaft 26 is mounted so that it can be removed by a user from its mounting, such as in a bracket 34. A further bush 36 may be provided. The bracket 34 includes a slot 38 through which the shaft 26 can be withdrawn to displace the means 18 from its use position. The slot 38 may be configured to retain the shaft 26 (via bush 36) with a latching action. For example the leading part of the slot may be made slightly narrower than the width of the bush 36 so that the bush 36 and/or the bracket 34 must be slightly deformed to remove or insert the shaft 26 in the slot 38. On releasing the shaft 26 from the bracket 34, the bush 32 is deformed to accommodate the movement of the shaft 26, as can be seen in Figure 8. The bush 32 allows the shaft to be moved until it is approximately perpendicular to its use position so that virtually unobstructed access can be gained to the light source 16.

By means of the present invention a slim fire is provided which is wall mountable, and which provides an excellent flame effect together with useful heating while having a depth of 200mm or less, preferably 180mm or less. In contrast, a conventional flame effect fire has a depth of the order of 300mm or more

Claims

- 5 1. Apparatus for producing an image comprising:
- i) a housing;
- ii) radiant heating means mounted to the housing and adapted to make the
 apparatus sensibly warm; and
- iii) an image providing assembly mounted in the housing and comprising:
- 10 (a) a light source;
- (b) a viewing screen capable of diffusing and transmitting light; and
- (c) means for modifying light from the light source to produce an image of
 moving light on the viewing screen,
- wherein the radiant heating means comprises at least one member selected
- 15 from the group comprising: a glass panel heater and a laminate heating
 means comprising an electrically insulating layer having an electrically
 conductive heating element thereon.
2. Apparatus as claimed in claim 1 wherein the image providing assembly
- 20 provides a simulation of flames on the viewing screen.
3. Apparatus as claimed in claim 1 or 2 wherein the laminate heating means is
 non-rigid.
- 25 4. Apparatus as claimed in claim 1, 2 or 3 wherein the housing is adapted for
 mounting on a substantially plane wall area.
5. Apparatus as claimed in any of claims 1 to 4 wherein the housing comprises
- a body portion and a frame portion mounted on the body portion, the frame
- 30 portion defining a viewing aperture through which the image from the image
 providing assembly is viewed in use.

6. Apparatus as claimed in claim 5 wherein the radiant heating means comprises said laminate heating means, the laminate being disposed on the inner surface of the frame portion.
- 5 7. Apparatus as claimed in any preceding claim wherein the viewing screen consists of said glass panel heater.
8. Apparatus as claimed in any preceding claim further comprising a substantially transparent front screen disposed on said housing in front of
10 the viewing screen.
9. Apparatus as claimed in claim 8 wherein the front screen consists of said glass panel heater.
- 15 10. Apparatus as claimed in claim 8 or 9 when dependent on claim 5 wherein the front screen is mounted on said body portion and within said viewing aperture.
11. Apparatus as claimed in any preceding claim wherein the means for
20 modifying the light from the light source comprises means for producing moving beams of light.
12. Apparatus as claimed in claim 11, wherein the means for producing moving beams of light comprises a shaft mounted substantially horizontally for
25 rotation about its axis, said shaft having a plurality of generally radially directed pieces of reflective material depending therefrom, said pieces being effective to reflect light from the light source onto the screen.
13. Apparatus as claimed in claim 12 wherein the shaft is disposed in front of
30 the plane of the viewing screen.
14. Apparatus as claimed in claim 12 or 13 wherein the shaft is driveably connected at its first end to a motor for rotation of the shaft and is retained

at its second end in a supporting bracket, the shaft having a flexible portion or a flexible connecting portion about by flexure of which the shaft is displaceable from its operative position thereby to permit access to the light source.

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15. Apparatus as claimed in claim 14 wherein the shaft is connected to the motor via a flexible bush and the second end of the shaft is releaseably mounted in the bracket, the shaft being displaceable when desired by flexure of the flexible bush.

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16. Apparatus as claimed in any preceding claim wherein the means for modifying light include reflecting means operative to reflect light from the light source onto the viewing screen.

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17. Apparatus as claimed in claim 16 wherein the reflecting means are operative to reflect light from the means for producing moving beams of light onto the viewing screen.

20

18. Apparatus as claimed in 16 or 17 wherein the reflecting means comprises a sheet of material having reflecting regions and non-reflecting regions.

19. Apparatus as claimed in claim 18 wherein the reflecting regions are generally flame shaped.

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20. Apparatus as claimed in claim 19 wherein the reflecting surface of the reflecting means is concave.

30

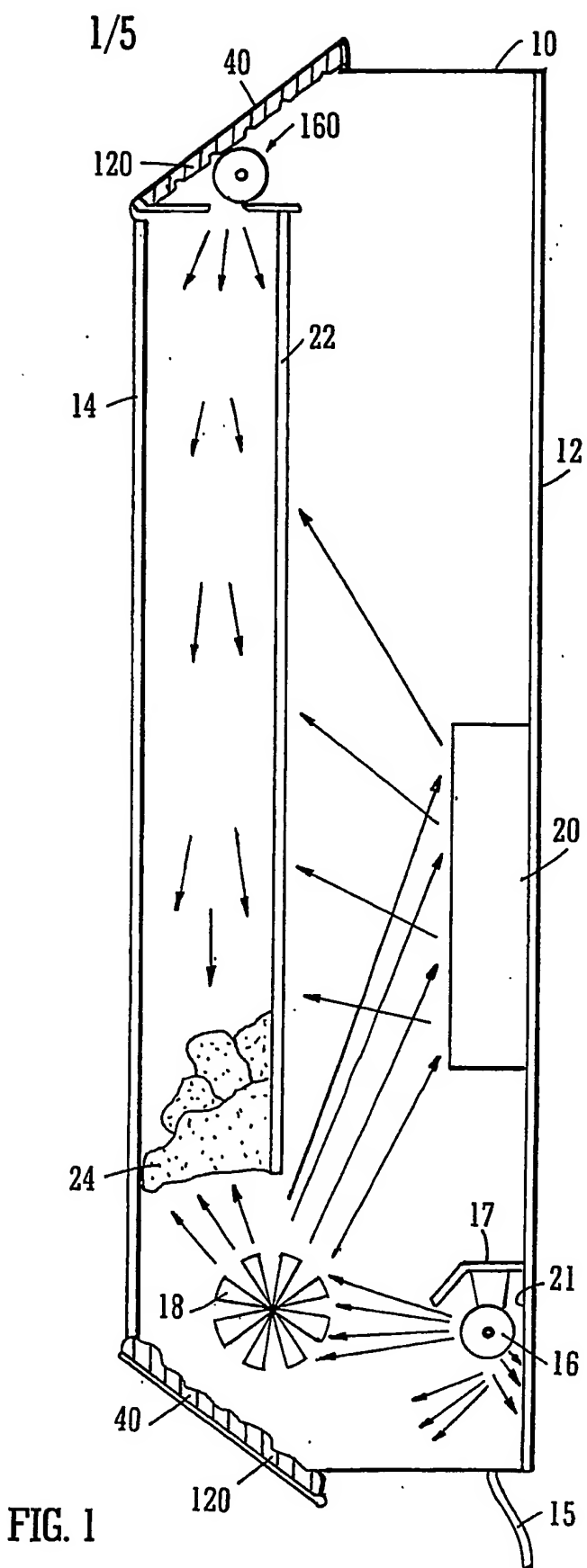
21. Apparatus as claimed in any of claims 16 to 20 wherein the reflecting means is mounted directly against a rear wall of the housing.

22. Apparatus as claimed in any preceding claim, further comprising a simulated fuel bed disposed directly in front of the viewing screen.

⋮

23. Apparatus as claimed in claim 22 wherein the viewing screen comprises a reflective front surface whereby a reflection of the fuel bed can be seen in the viewing screen.
- 5 24. Apparatus as claimed in any preceding claim the light source comprises a plurality of bulbs mounted adjacent a rear wall of the housing.
25. Apparatus as claimed in claim 24 comprising at least three horizontally aligned bulbs
- 10 26. Apparatus as claimed in claim 24 or 25 wherein the bulbs each have a width (front to back dimension when in use) of not more than about 40mm.
- 15 27. Apparatus as claimed in claim 26 wherein the bulbs have a width of not more than about 35mm.
28. Apparatus as claimed in any preceding claim further comprising at least one reflector mounted between the light source and a rear wall of the housing.
- 20 29. Apparatus as claimed in any preceding claim further comprising a baffle arranged to prevent light from the light source from falling directly on the viewing screen.
- 25 30. Apparatus as claimed in any preceding claim wherein the laminate heating means has an output of about 200W.
31. Apparatus as claimed in any preceding claim wherein the glass panel heater has an output of from about 50W to about 200W.
- 30 32. Apparatus as claimed in claim 31 wherein the glass panel heater has an output of from about 80W to about 150W.

33. Apparatus substantially as hereinbefore described with reference to any of Figures 1 to 8.



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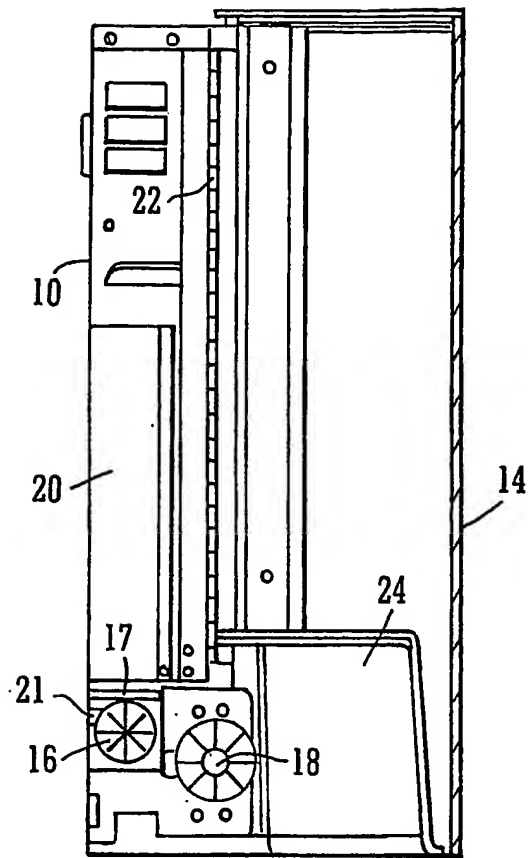


FIG. 2

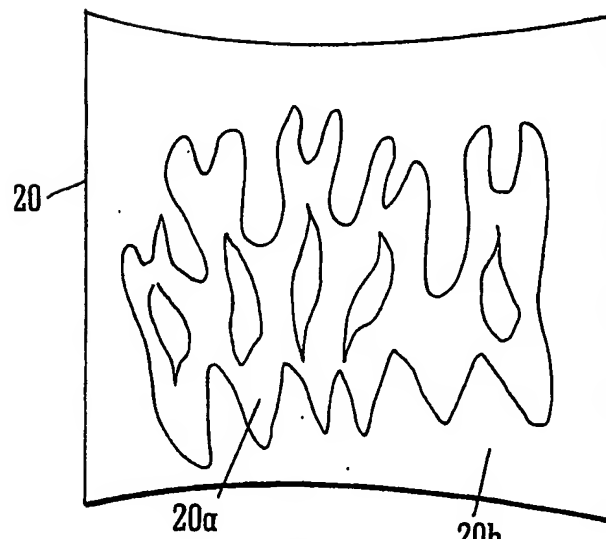


FIG. 3

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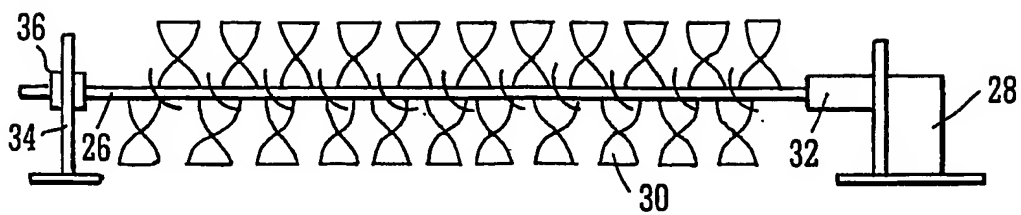


FIG. 4

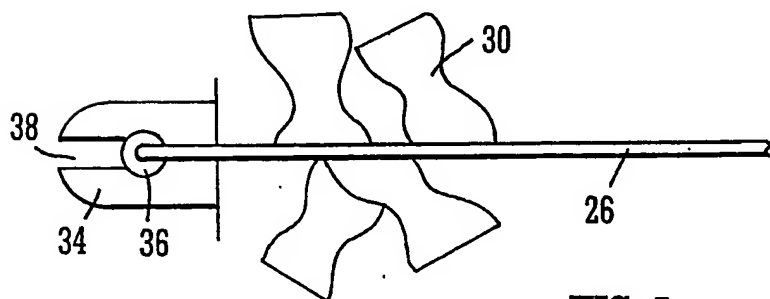


FIG. 5

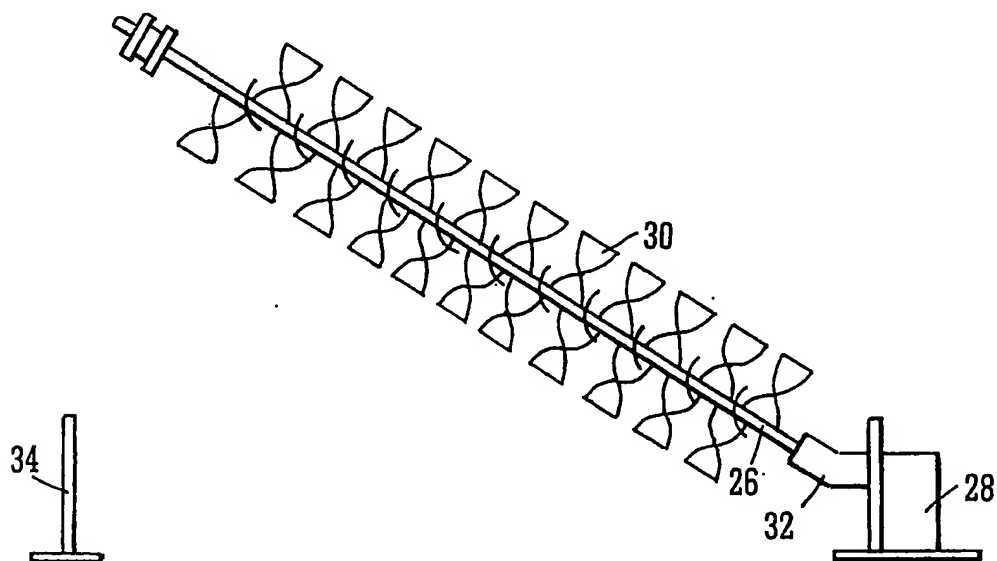


FIG. 6

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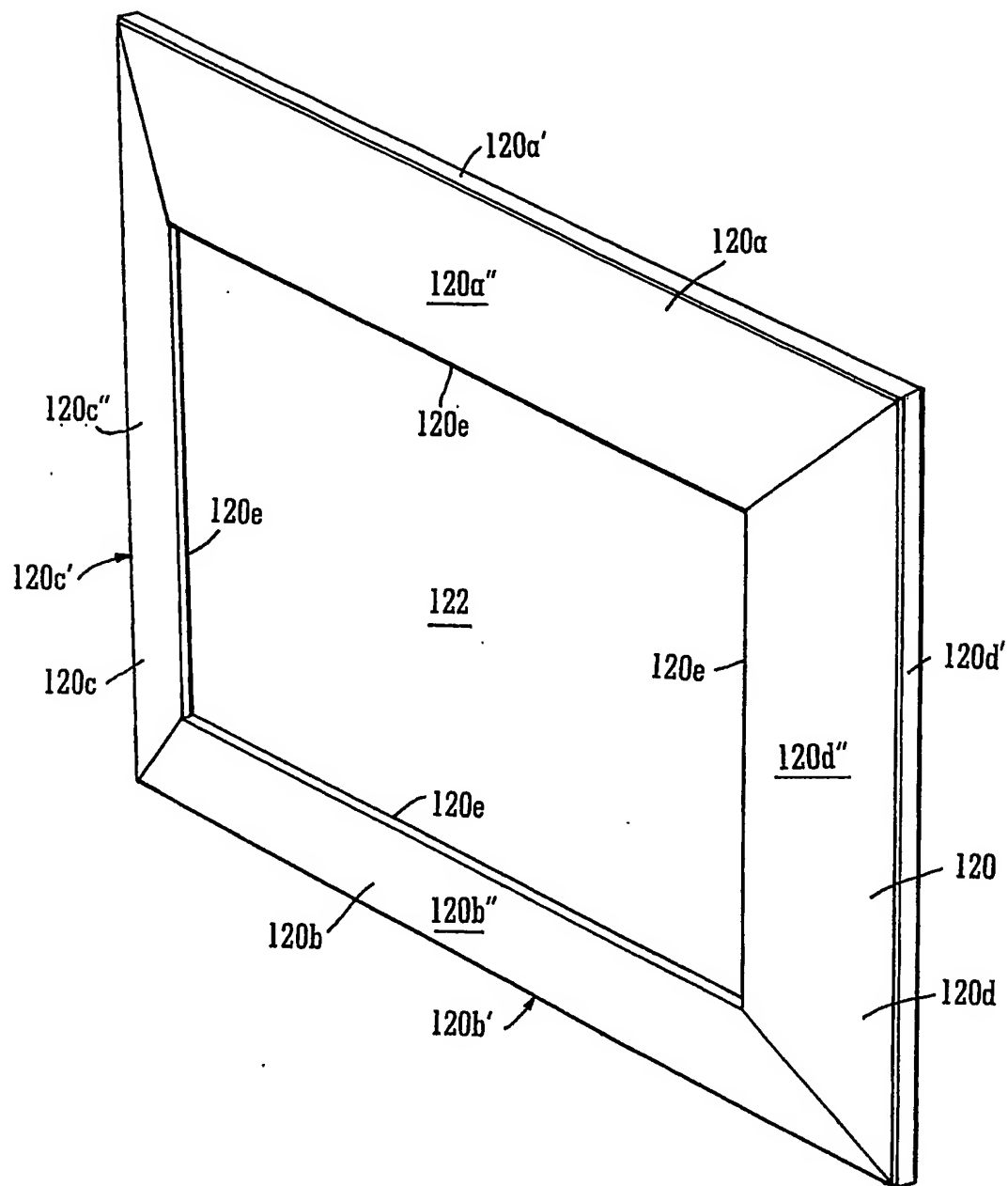


FIG. 7

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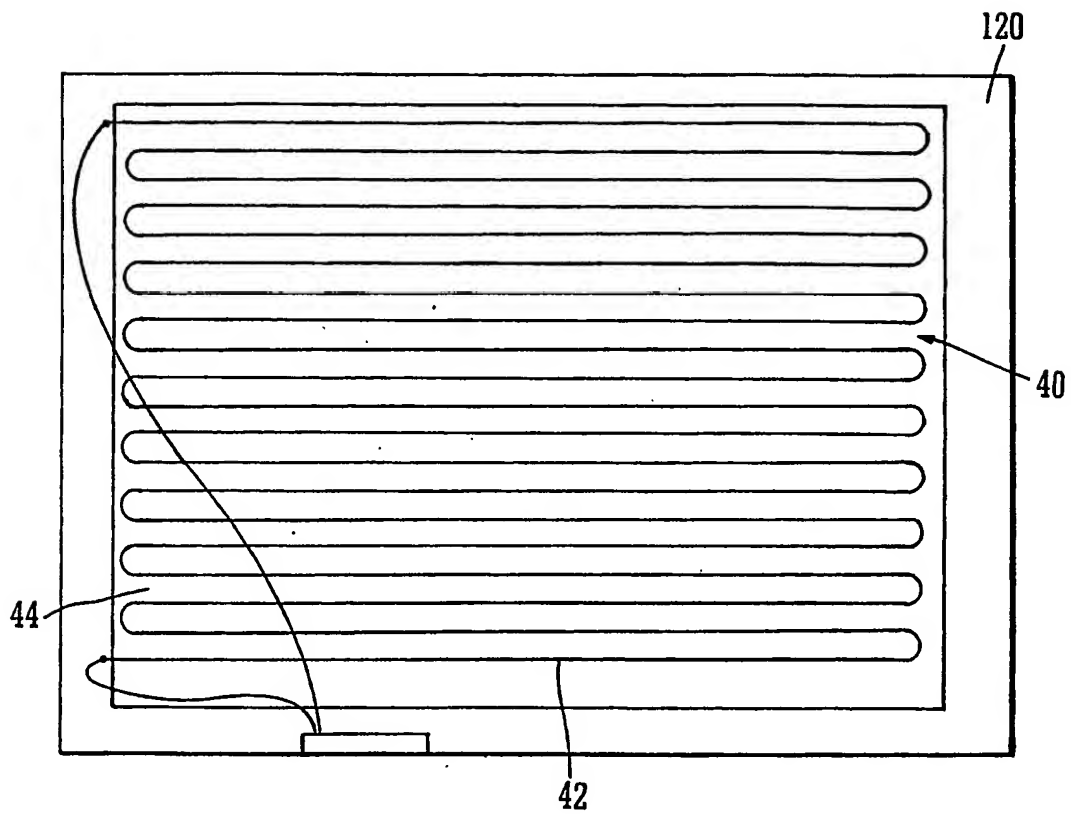


FIG. 8

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 F24C7/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F24C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 377 753 A (VALOR LTD) 22 January 2003 (2003-01-22)	1,2,4,5, 7-33
Y	page 13, line 14 - page 14, line 6; figures 1,2,4,7,11,12	3,6
X	US 2002/170215 A1 (LYONS DAVID CHARLES ET AL) 21 November 2002 (2002-11-21)	1,2,4,5, 8-22, 24-33
	paragraphs '0058! - '0068!; figures 7-12	
Y	GB 407 596 A (UNITY HEATING LTD; DAVID GRANT PETRIE) 22 March 1934 (1934-03-22)	3,6
	page 2; figures 1,3	
X	US 2003/041491 A1 (MIX DEVIN EUGENE) 6 March 2003 (2003-03-06)	1,9
	paragraphs '0029! - '0033!; figures 1-3	
	----- -/-	



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Date of the actual completion of the International search

20 September 2004

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
GB 2377753	A	22-01-2003	WO 02077533 A1	03-10-2002
			GB 2389650 A	17-12-2003
US 2002170215	A1	21-11-2002	CA 2386590 A1	16-11-2002
GB 407596	A	22-03-1934	NONE	
US 2003041491	A1	06-03-2003	NONE	
WO 0104544	A	18-01-2001	AU 6166500 A	30-01-2001
			WO 0104544 A1	18-01-2001
			GB 2368389 A , B	01-05-2002
CA 2175442	C	31-10-1997	CA 2175442 A1	31-10-1997
			AT 219229 T	15-06-2002
			AU 734355 B2	14-06-2001
			AU 2377797 A	19-11-1997
			CA 2204106 A1	30-10-1997
			CA 2310073 A1	30-10-1997
			CA 2310343 A1	30-10-1997
			CA 2310362 A1	30-10-1997
			CA 2310367 A1	30-10-1997
			CA 2310414 A1	30-10-1997
			WO 9741393 A1	06-11-1997
			CN 1410705 A	16-04-2003
			CN 1410703 A	16-04-2003
			DE 69713322 D1	18-07-2002
			DE 69713322 T2	30-01-2003
			EP 1199524 A2	24-04-2002
			EP 1199525 A2	24-04-2002
			EP 1199526 A2	24-04-2002
			EP 1199527 A2	24-04-2002
			EP 0897514 A1	24-02-1999
			JP 2001509873 T	24-07-2001
			NZ 333010 A	26-05-2000
			PL 329604 A1	29-03-1999
EP 0202864	A	26-11-1986	EP 0202864 A2	26-11-1986
WO 9741393	A	06-11-1997	CA 2175442 A1	31-10-1997
			US 6047489 A	11-04-2000
			AT 219229 T	15-06-2002
			AU 734355 B2	14-06-2001
			AU 2377797 A	19-11-1997
			CA 2204106 A1	30-10-1997
			CA 2310073 A1	30-10-1997
			CA 2310343 A1	30-10-1997
			CA 2310362 A1	30-10-1997
			CA 2310367 A1	30-10-1997
			CA 2310414 A1	30-10-1997
			WO 9741393 A1	06-11-1997
			CN 1410705 A	16-04-2003
			CN 1410703 A	16-04-2003
			DE 69713322 D1	18-07-2002
			DE 69713322 T2	30-01-2003
			EP 1199524 A2	24-04-2002
			EP 1199525 A2	24-04-2002
			EP 1199526 A2	24-04-2002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9741393	A	EP 1199527 A2	24-04-2002
		EP 0897514 A1	24-02-1999
		JP 2001509873 T	24-07-2001
		NZ 333010 A	26-05-2000
		PL 329604 A1	29-03-1999
		US 6269567 B1	07-08-2001
US 495707	A	NONE	
EP 0611921	A	24-08-1994	
		GB 2275105 A	17-08-1994
		AT 185188 T	15-10-1999
		DE 69420875 D1	04-11-1999
		DE 69420875 T2	25-05-2000
		DK 611921 T3	17-04-2000
		EP 0611921 A2	24-08-1994
		ES 2140501 T3	01-03-2000

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